CBSE Class 12 Physics Exam 2025-26

Sample Practice Test - 4

SECTION-A

1. Three capacitors each of 4 μF are to be connected in such a way that the effective capacitance is 6μF. This can be done by connecting them :
   (A) all in series
   (B) all in parallel
   (C) two in parallel and one in series
   (D) two in series and one in parallel

2. A charged particle of mass m and charge q travels on a circular path of radius r that is perpendicular to a magnetic field B. The time taken by the particle to complete one revolution is
   (A) $\frac{2\pi q^2 B}{m}$
   (B) $\frac{2\pi mq}{B}$
   (C) $\frac{2\pi m}{qB}$
   (D) $\frac{2\pi qB}{m}$

3. Two thin, long, parallel wires, separated by a distance 'd' carry a current of 'i' A in the same direction. They will
   (A) repel each other with a force of $\mu_0 i^2/(2\pi d)$
   (B) attract each other with a force of $\mu_0 i^2/(2\pi d)$
   (C) repel each other with a force of $\mu_0 i^2/(2\pi d^2)$
   (D) attract each other with a force of $\mu_0 i^2/(2\pi d^2)$

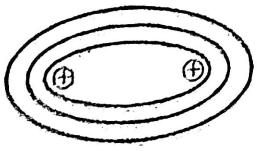
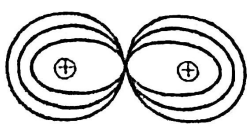
4. Match the entries of column I with that of Column II.

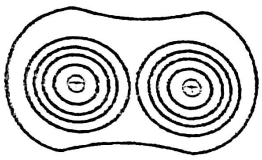
Column I	Column II
(P) Coulomb's law	(1) Total electric flux through a closed surface.
(Q) Gauss's law	(2) Vector sum of forces.
(R) Principle of superposition	(3) Force is inversely proportional to square of distance
(S) Quantisation of charge	(4) Discrete nature of charge

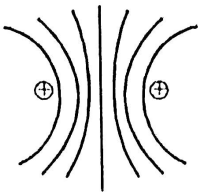
   (A) (P) → (2), (Q) → (3), (R) → (1), (S) → (4)
   (B) (P) → (3), (Q) → (1), (R) → (2), (S) → (4)
   (C) (P) → (1), (Q) → (4), (R) → (3), (S) → (2)
   (D) (P) → (1), (Q) → (2), (R) → (3), (S) → (4)

5. The current sensitivity of a galvanometer is defined as
   (A) the current flowing through the galvanometer when a unit voltage is applied across its terminals.
   (B) current per unit deflection.
   (C) deflection per unit current.
   (D) dflection per unit current when a unit voltage is applied across its terminals

6. A circular coil of wire consisting of 100 turns each of radius 9 cm carries a current of 0.4 A. The magnitude of magnetic field at the centre of the coil is
   (A) 2.4×10^{-4} T
   (B) 3.5×10^{-4} T
   (C) 2.79×10^{-4} T
   (D) 3×10^{-4} T

7. Which of the following figure shows the correct equipotential surfaces of a system of two positive charges?
   (A) 
   (B) 

(C) 

(D) 

8. Light travels in two media M_1 and M_2 with speeds 1.5×10^8 ms^{-1} and 2.0×10^8 ms^{-1} respectively. The critical angle between them is:

(A) $\tan^{-1}\left(\frac{3}{\sqrt{7}}\right)$ (B) $\tan^{-1}\left(\frac{2}{3}\right)$

(C) $\cos^{-1}\left(\frac{3}{4}\right)$ (D) $\sin^{-1}\left(\frac{2}{3}\right)$

9. The phenomenon of diffraction can be treated as interference phenomenon if the number of coherent sources is

(A) one (B) two (C) zero (D) infinity

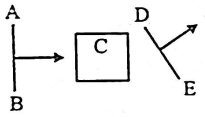
10. A wavefront AB passing through a system C emerges as DE. The system C could be

(A) a slit

(B) a biprism

(C) a prism

(D) a glass slab



11. A double convex lens of focal length 6 cm is made of glass of refractive index 1.5. The radius of curvature of one surface is double that of other surface. The value of small radius of curvature is

(A) 6 cm (B) 4.5 cm (C) 9 cm (D) 4 cm

12. Which of the following statements is not correct according to Rutherford model ?

(A) Most of the space inside an atom is empty.

(B) The electrons revolve around the nucleus under the influence of coulomb force acting on them.

(C) Most part of the mass of the atom and its positive charge are concentrated at its centre.

(D) The stability of atom was established by the model.

For question numbers 13 to 16, two statements are given-one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below.

(A) If both A and R are true and R is the correct explanation of A

(B) If both A and R are true but R is NOT the correct explanation of A

(C) If A is true but R is false

(D) If both A and R are false

13. **Assertion (A) :** The alternating current lags behind the e.m.f by a phase angle of $\pi/2$, when current flows through an inductor.
Reason (R) : The inductive reactance increases as the frequency of ac source decreases.

14. **Assertion (A) :** The focal length of an equiconvex lens of radius of curvature R made of material of refractive index $\mu = 1.5$, is R.
Reason (R) : The focal length of the lens will be R/2.

15. **Assertion (A) :** EM waves used for optical communication have longer wavelengths than that of microwave, employed in Radar technology.

Reason (R) : Infrared EM waves are more energetic than microwaves, (used in Radar)

16. **Assertion (A) :** When a magnetic dipole is placed in a non-uniform magnetic field, only a torque acts on the dipole.

Reason (R) : Force would also act on dipole if magnetic field were uniform.

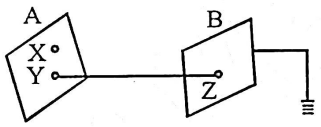
SECTION-B

17. A coil of 200 turns has a cross-sectional area 900 mm^2. It carries a current of 2A. The plane of the coil is perpendicular to a uniform magnetic field of 0.5 T. Calculate (i) the magnetic moment of the coil and (ii) the torque acting on the coil.

18. Two identical plane metallic surfaces A and B are kept parallel to each other in air, separated by a distance of 1 cm as shown in the figure. A is given a positive potential of 10 V and the outer surface of B is earthed.

(I) What is the magnitude and direction of the uniform electric field between Y and Z?

(II) What is the workdone in moving a charge of 20 μC from X to Y?



19. Give two characteristics of electromagnetic waves. Write the expression for velocity of electromagnetic waves in terms of permittivity and permeability of the medium.

OR

Identify the part of the electromagnetic spectrum which is

(I) suitable for radar systems used in air craft navigation.

(II) adjacent to low frequency end of the electromagnetic spectrum.

(III) produced in nuclear reactions.

(IV) produced by bombarding a metal target by high speed electrons.

20. State Lenz's law.

A metallic rod held horizontally along east-west direction, is allowed to fall under gravity. Will there be an emf induced at its ends? Justify your answer.

21. Two concentric circular coils, one of small radius r and the other of large radius R, such that R >> r, are placed coaxially with centres coinciding. Obtain the mutual inductance of the arrangement.

OR

Derive the formula for the self inductance of a long solenoid.

SECTION-C

22. Answer the following questions :

(A) In a double slit experiment using light of wavelength 600 nm, the angular width of the fringe formed on a distant screen is 0.1°. Find the spacing between the two slits.

(B) Light of wavelength 5000 Å propagating in air gets partly reflected from the surface of water. How will the wavelengths and frequencies of the reflected and refracted light be affected?

23. What is the emf of a cell ? State the factors on which its value depends. Derive a relation between emf E, contact potential V, internal resistance r of a cell and external resistance R. Proove that emf is more than potential difference.

24. An electric dipole consists of the two particles, having the opposite charges $+2 \times 10^{-6}$ C and -2×10^{-6} C and separated by a distance of 10^{-2} m. What is the electric dipole moment of the dipole? Calculate the electric field at a point P on the axis of dipole at a distance of 1 m from it's mid point. Also, calculate the electric field at a point P on the equator of dipole at a distance of 1 m from its mid point.

25. In a Geiger-Marsden experiment, calculate the distance of closest approach to the nucleus of $Z = 80$, when an α-particle of 8 MeV energy impinges on it before it comes to momentarily rest and reverses its direction.

How will the distance of closest approach be affected when the kinetic energy of the α-particle is doubled?

26. Assuming that p^+ and n^0 have equal masses, calculate how many times nuclear matter is denser than water. Take m(nucleon) $= 1.67 \times 10^{-27}$ kg and $R_0 = 1.2 \times 10^{-15}$m.

27. Distinguish between 'intrinsic' and 'extrinsic' semiconductors.

28. Draw a labelled ray diagram showing the formation of a final image by a compound microscope at least distance of distinct vision.

OR

The total magnification produced by a compound microscope is 20. The magnification produced by the eye piece is 5. The microscope is focussed on a certain object. The distance between the objective and eyepiece is observed to be 14 cm. If least distance of distinct vision is 20 cm, calculate the focal length of the objective and the eye piece.

SECTION-D

29. R.M.S value of alternating current is the steady current which when passed through a given resistor for a certain time, shall produce the same heat as the given A.C. shall do when passed for the same time.

$$I_{rms} = \frac{I_0}{\sqrt{2}} = 0.707 I_0, E_{rms} = \frac{E_0}{\sqrt{2}} = 0.707 E_0$$

(I) The alternating current of equivalent value of $\frac{I_0}{\sqrt{2}}$ is

(A) peak current
(B) r.m.s. current
(C) D.C. current
(D) all of these

(II) The r.m.s value of an a.c. of 50 Hz is 10 amp. The time taken by the alternating current in reaching from zero to maximum value and the peak value of current will be

(A) 2×10^{-2} sec and 14.14 amp
(B) 1×10^{-2} sec and 7.07 amp
(C) 5×10^{-3} sec and 7.07 amp
(D) 5×10^{-3} sec and 14.14 amp

(III) The instantaneous voltage through a device of impedance 20 Ω is $e = 80 \sin 100 \pi t$. The effective value of the current is

(A) 3 A
(B) 2.828 A
(C) 1.732 A
(D) 4 A

(IV) The voltage of an ac supply varies with time (t) as $V = 120 \sin 100 \pi t \cos 100 \pi t$. The maximum voltage and frequency respectively are

(A) 120 volt, 100 Hz

(B) $\frac{120}{\sqrt{2}}$ volt, 100 Hz

(C) 60 volt, 200 Hz

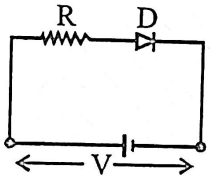
(D) 60 volt, 100 Hz

30. Rectifier is a device which converts ac to dc.

If an alternating voltage is applied across a diode in series with a load, a pulsating voltage will appear across the load only during the half cycles of the ac input during which the diode is forward biased. Such rectifier circuit, as shown in fig. is called a **half-wave rectifier.**

The circuit using two diodes, gives output rectified voltage corresponding to both the positive as well as negative half of the ac cycle. Hence, it is known as ***full-wave rectifier.***

(I) A d.c. battery of V volt is connected to a series combination of a resistor R and an ideal diode D as shown in the figure below. Find the potential difference across R.



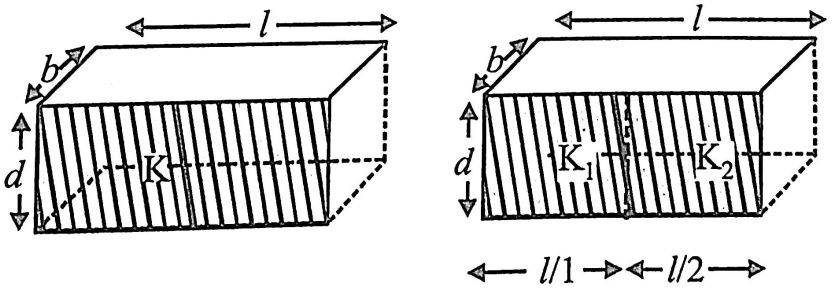
(II) In the half wave rectifier circuit operating from 50 Hz mains frequency, find the fundamental frequency in the ripple

(III) A full wave rectifier circuit consists of two p-n junction diodes, a centre–tapped transformer, capacitor and a load resistance. Which of these components remove the ac ripple from the rectified output?

SECTION-E

31. (A) Obtain the expression for the potential due to an electric dipole of dipole moment p at a point 'x' on the axial line.

(B) Two identical capacitors of plate dimensions : $l \times b$ and plate separation d have dielectric slabs filled in between the space of the plates as shown in the figures.



Obtain the relation between the dielectric constants K, K_1 and K_2.

OR

A parallel plate capacitor with air as dielectric is charged by a d.c. source to a potential V. Without disconnecting the capacitor from the source, air is replaced by another dielectric medium of dielectric constant 10. State with reason, how does

(I) electric field between the plates and

(II) energy stored in the capacitor change.

32. (A) Why photoelectric effect cannot be explain on the basis of wave nature of light? Give reasons.

(B) Write the basic features of photon picture of electromagnetic radiation on which Einstein's photoelectric equation is based.

OR

Write Einstein's photoelectric equation and mention which important features in photoelectric effect can be explained with the help of this equation.

The maximum kinetic energy of the photoelectrons gets doubled when the wavelength of light incident on the surface changes from λ_1 to λ_2. Derive the expressions for the threshold wavelength λ_0 and work function for the metal surface.

33. (A) Write the necessary conditions to obtain sustained interference fringes.

(B) In Young's double slit experiment, plot a graph showing the variation of fringe width versus the distance of the screen from the plane of the slits keeping other parameters same. What information can one obtain from the slope of the curve?

(C) What is the effect on the fringe width if the distance between the slits is reduced keeping other parameters same?

OR

(A) Write two characteristics features distinguishing the diffraction pattern from the interference fringes obtained in Young's double slit experiment.

(B) Two wavelengths of sodium light 590 nm and 596 nm are used, in turn, to study the diffraction taking place due to a single slit of aperture 1×10^{-4} m. The distance between the slit and the screen is 1.8 m. Calculate the separation between the position of the first maxima of the diffraction pattern obtained in the two cases.